Jackstone in the renal calyx: A rare case report

Song HF et al. Jackstone in the renal calyx

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Abstract

BACKGROUND
Jackstone is a rare entity of calculi in urinary tracts and has the characteristic appearance resembling toy jacks. They are nearly always reported to occur in the urinary bladder, we first report a rare case of jackstone located in the obstructed renal calyx.

CASE SUMMARY
We report a 46-year-old man presenting with intermittent, painless gross hematuria and left flank pain. Urinary computed tomography revealed staghorn stones and secondary hydronephrosis. A jackstone with radiating branches was found in one of the dilated renal calyx. Percutaneous nephrolithotomy was performed and endoscopic images were recorded during the operation. Postoperative stone composition analysis revealed it as calcium oxalate monohydrate stones.

CONCLUSION
Jackstones can occur in the renal collecting system besides the bladder. The unique appearance and imaging manifestations are the most important factors in the diagnosis of jackstones, and further exploration of the formation mechanism is required.

Key Words: Jackstone; Renal calyx; Obstruction; Case report


Core Tip: As a rare entity, jackstone with the characteristic appearance resembling toy jacks is usually found in the urinary bladder. This study discusses a rare case of a jackstone in a hydronephrotic renal calyx which had never been described before. Jackstones are commonly composed of calcium oxalate monohydrate or calcium oxalate
dihydrate. The exact pathophysiology of jackstone development remains poorly understood. Outflow obstruction may be the most common cause. Thus, when removing the stones, the obstruction should also be evaluated and treated to avoid recurrence.

**INTRODUCTION**

Jackstones are named for their radiating appearance, which resembles toy jacks[1]. They have been reported in different animals[2] and humans and are usually found in the urinary bladder but rarely found in the kidneys[3,4]. The most common jackstones include those composed of calcium oxalate monohydrate and calcium oxalate dihydrate[5]. Here, we report a rare case of a jackstone composed of calcium oxalate monohydrate located in a hydronephrotic renal calyx.

**CASE PRESENTATION**

*Chief complaints*

A 46-year-old man presented with intermittent, painless gross hematuria and left flank pain after activity for one month.

*History of present illness*

About one month ago, the patient developed intermittent gross hematuria and distending pain of the left flank for unknown reasons, without frequency, urgency, and painful urination. He also had no fever, nausea, and vomiting.

*History of past illness*

The patient had a history of primary hypertension for one year, he took 80 mg valsartan orally per day. The blood pressure was controlled well. He also had bilateral saphenous varicose veins for 20 years and never treated. The patient was allergic to sulfonamides.
Personal and family history

The patient’s personal and family history was not remarkable.

Physical examination

On physical examination, the vital signs were normal and there were no positive signs except percussive pain in the left renal region.

Laboratory examinations

The routine urine analysis showed full field of red and white blood cells. The urine culture indicated Enterococcus faecalis (> 100000 CFU/mL). The patient’s serum creatine was slightly elevated (135 μmol/L). NMP22 and urine cytology were negative. No abnormality was found in other routine blood tests.

Imaging examinations

Urinary computed tomography (CT) revealed staghorn stones in the left kidney, filling the renal pelvis and several calices with secondary hydrenephrosis. A stellate stone with characteristic radiating spicules (suspected to be a jackstone) was found in one of the dilated upper renal calyces, measuring 0.8 cm × 1.0 cm with a maximum density of 1240 Hounsfield units (HU) (Figure 1). There was no stone or obstruction found in the ureter. Prostate calculi were also found on CT image.

FINAL DIAGNOSIS

The final major diagnosis was kidney stone, other diagnoses included hydrenephrosis, urinary infection, kidney injury, and prostate calculi.

TREATMENT

After antibiotics therapy (levofloxacin, 0.5 g, ivgtt) for three days, prone percutaneous nephrolithotomy was performed. Two standard channels were established to remove the stones. During the surgery, it was observed that the stones blocked the funnel of the
upper calyx and a jackstone located in the dilated calyx (Figure 2). There was no obstruction at the ureteropelvic junction. All stones were completely removed using ultrasound lithotripsy and a double J stent and nephrostomy tubes were then placed.

OUTCOME AND FOLLOW-UP
The patient recovered smoothly with no complications occurred and was discharged 7 days after surgery. Nephrostomy tubes were removed during hospitalization. One month after, the left double-J stent was removed successfully. Postoperative infrared spectroscopy analysis demonstrated that the jackstone was composed of calcium oxalate monohydrate.

DISCUSSION
Jackstone is a type of urinary calculi with a distinctive appearance and are usually reported in the bladder. Despite its distinct shape, the clinical manifestations of jackstone are not unique or specific. Therefore, medical imaging examinations and visual inspection are necessary for diagnosis. Patients with jackstones often exhibit intermittent gross hematuria, obstructive lower urinary tract symptoms, and abdominal or flank pain, making these patients seek medical attention[8,6,7].

Jackstones located in the collecting system are extremely rare. In previous reports, jackstones were usually located in the renal pelvis[8,9]. Symeonidis et al[3] summarized 14 previously published cases of jackstones found in the urinary tract: 78.6% of patients had single jackstones; 2 cases had renal stones and the remaining 12 patients had bladder stones[3]. However, the exact pathophysiology of jackstone development remains poorly understood. Outflow obstruction may be the most common cause. Lim et al[7] reported two jackstone calculi in the renal pelvis in a 53-year-old man with ureteropelvic junction obstruction. They suggested that the capacious renal pelvis caused by obstruction enabled the formation of the jackstones[7]. In our case, the jackstone was located in an obstructed renal calyx, which has not been previously reported. This indicates that jackstone formation can be observed in any location where
the obstruction is present in the urinary tract. However, in another case report by Goonewardena et al[9], a jackstone occurred in the renal pelvis without significant obstruction in the ureteropelvic junction demonstrated in the renogram curve. Therefore, the mechanism of jackstone's occurrence still remains uncertain and needs further clarification.

In our case, stone composition analysis using infrared spectroscopy revealed calcium oxalate monohydrate. According to previous reports, bladder jackstones were commonly composed of calcium oxalate monohydrate or calcium oxalate dihydrate. Grases et al[10] reported a jackstone in the renal pelvis composing of calcium oxalate monohydrate. Canela et al[3] used micro-CT and infrared spectroscopy to examine 98 jackstones, the largest case series of jackstones to date. They showed that jackstones had an X-ray transparent core within the outer projecting spines, with an outer shell that was always composed of calcium oxalate (CaOx). Immunohistochemistry showed that the core was partially enriched with Tamm-Horsfall protein. They suggested that this protein-rich core might preferentially bind to more proteins in the urine, causing the spines to grow in a linear fashion and at a faster rate. Of note, in our case, the jackstone was fragmented intraoperatively, making it impossible to explore whether our jackstone could fit this pattern.

CONCLUSION
In conclusion, we report the case of a typical jackstone in a hydrouphrrotic renal calyx that has rarely been reported in the literature. The unique spike-like appearance and imaging manifestations resembling toy jacks were the most important factors for diagnosing jackstones. Although most studies attribute its occurrence to urinary tract obstruction, further investigation is still needed.
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